

***PSALLUS VARIABILIS* (FALLÉN) AND *P. ALBIPENNIS*  
(FALLÉN), TWO EUROPEAN PLANT BUGS ESTABLISHED  
IN NORTH AMERICA, WITH NOTES ON TAXONOMIC  
CHANGES (HEMIPTERA: HETEROPTERA: MIRIDAE)**

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*Abstract.*—The Palearctic phyline mirids *Psallus variabilis* (Fallén) and *P. albipennis* (Fallén) were collected and found established on Long Island, New York, in 1981–1982. These are the first substantiated records for *variabilis* in North America and the first published record of a breeding population of *albipennis* in North America. On Long Island, adults and nymphs of *P. variabilis* were collected from staminate inflorescences of scrub oak, *Quercus ilicifolia* Wang.; adults also were taken from *Q. coccinea* Muenchh. and several other plants. Adults and nymphs of *P. albipennis* were collected from leaves and stems of common sagewort, *Artemisia campestris* L.

The adult and fifth-instar nymph of both species are described and illustrated; the male genitalia of each species also are illustrated. A review of the European literature discussing host plants and seasonal history is presented for both species. In addition, an unpublished record of *P. albipennis* from Minnesota is given. *Psallus waldeni* Knight is proposed as a junior synonym of *P. albipennis*, new synonymy; and *albipennis* is formally transferred from *Plagiognathus* to *Psallus*, new combination.

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As part of the USDA-APHIS "High Hazard Pest Survey" program, Hoebeke (1980) identified the mirid *Psallus variabilis* (Fallén), based on a specimen collected at Oyster Bay, Long Island, N.Y. Although Van Duzee (1889) had reported this European plant bug from Ontario and later (1894) from New York, Knight (1927), after examining Van Duzee's specimens, considered them to represent a native species, *Lepidopsallus rubidus* var. *atricolor* Knight. The Long Island collection thus is the first New World record for *P. variabilis*.

We visited the Oyster Bay area in May 1981 and 1982 to confirm the establishment of *P. variabilis* and to determine its host range. On the Long

Island trips we also collected the Palearctic *Psallus albipennis* (Fallén), a mirid recorded in the New World only from Bradore Bay, Quebec (Moore, 1950). We now confirm that this *Artemisia* feeder is established in North America.

In this paper we provide descriptions and illustrations for the adult and fifth-instar nymph of both species; the male genitalia of each species also are illustrated. We also propose *Psallus waldeni* Knight, described from Connecticut in 1923, as a junior synonym of the Palearctic *Psallus albipennis*, and transfer *albipennis* from *Plagiognathus* to *Psallus*.

### *Psallus variabilis* (Fallén)

Butler (1923) considered *P. variabilis* one of the most common British heteropterans. Although in England it apparently is confined to species of *Populus* and *Salix* (Southwood and Leston, 1959), on the continent it feeds mainly on oak (*Quercus* spp.). Kullenberg (1944) recorded this mirid from *Quercus macranthera* Fisch. and Mey., *Q. petraea* L. ex Liebl. (cited as *Q. sessiliflora* Salisb.), and *Q. robur* L. Scudder (1956) also said it is common on *Q. petraea*, and Ehanno (1965) recorded populations on *Q. robur* (cited as *Q. pedunculata* Ehrh.) and on *Q. ilex* L. On oak, Kullenberg observed that feeding takes place on young shoots and leaf veins, as well as on catkin stalks and pollen sacs. He noted that when staminate inflorescences of oak begin to dry the late instars and adults move to the pistillate flowers. We believe that the large number of "hosts" listed in the European literature (e.g., Stichel, 1956) reflect a movement to other plant species, especially their inflorescences, when reproductive structures of oak have shriveled. Kullenberg (1944) and Strawinski (1964) stated that *P. variabilis* often supplements its diet with soft-bodied prey occurring on its host plants.

*Psallus variabilis* is a univoltine species that overwinters in the egg stage; adults are present from mid-June to early August (Kullenberg, 1944) or may appear as early as mid-May (Aukema, 1981). The October record of Butler (1923) must be based on a misidentification. Indeed, the subgenus to which *variabilis* belongs, *Hylopsallus* Wagner, includes several closely related oak feeders (e.g., *perrisi* Mulsant) that can be separated reliably only by characters of the male genitalia (Aukema, 1981). Woodroffe (1957) believes that many of the British records of *variabilis* should be referred to *perrisi*.

The first North American record of *P. variabilis* resulted from the collection of an adult female in the Planting Fields Arboretum, Oyster Bay, Long Island, on June 6, 1979; the specimen was taken in a vegetable garden by K. Uchida as part of the USDA-APHIS "High Hazard" survey. Following the identification of this specimen (by ERH) in June 1980, we made plans to make additional collections in 1981.

On May 29, 1981, we found a small population of *P. variabilis* at the Planting Fields Arboretum; five adults were collected on scarlet oak, *Quer-*

*cus coccinea* Muenchh., growing in a hedgerow. Single specimens were taken on a nearby red maple, *Acer rubrum* L., and a quaking aspen, *Populus tremuloides* Michx. The next day we collected two adults from the inflorescences of *Viburnum recognitum* Fernald growing in the same hedgerow, and two adults at Port Jefferson on a fir, *Abies* sp., whose needles were coated with honeydew from an aphid infestation.

We found a larger population of *P. variabilis* on May 30 at Center Moriches on southeastern Long Island; about 40 adults and six fifth-instar nymphs were beaten from staminate inflorescences of scrub oak, *Q. ilicifolia* Wang. The trees, part of a dense thicket dominated by bayberry, *Myrica pennsylvanica* Loisel., were growing along a railroad.

In May 1982 we found large numbers of adults on flowers of black cherry (*Prunus serotina* Ehrh.), hawthorn (*Crataegus* sp.), and downy serviceberry (*Amelanchier arborea* (Michx.) Fern.) after catkins had largely dropped from nearby oaks. We collected *P. variabilis* at these additional localities in Suffolk Co., Long Island, during May 28–30, 1982: Bayard Cutting Arboretum, Oakdale; Blue Point; and near Tiana Bay.

Our limited observations suggest that *P. variabilis* is a univoltine, early-season mirid associated mainly with staminate inflorescences of oaks. Based on the European literature and our collections, adults on Long Island probably appear by mid-May and are present only until mid- to late June. In the Planting Fields Arboretum the staminate flowers had withered and fallen from most of the scarlet oaks, and the mirid population already may have begun to decline. Our collection of adults on inflorescences of various plant species probably reflected a dispersal to an alternate food source. On southeastern Long Island at Center Moriches, the scrub oaks still retained their male catkins although some had withered; the development of mirid populations on scrub oak in 1981 lagged slightly behind that on scarlet oak at Oyster Bay.

*Psallus variabilis* appears well established on Long Island, and the large numbers found on native scrub oak suggest that it has been present for several years, if not longer. This mirid is widely distributed on Long Island; we have seen a specimen collected by Roy Latham from the northern peninsula. His unlabeled specimen was among material donated to Cornell University and known to have been collected in the Orient area between 1968 and 1978 when this well-known naturalist was in his 80's, or nearly 90 (L. L. Pechuman, personal communication).

*Psallus variabilis* most likely was introduced with nursery stock imported from Europe. Long Island, site of the first nursery in the New World (Bailey, 1935; Hedrick, 1950), was an early center of plant importation. Imported plants were purchased by nurseries, as well as by private estates. In fact, the Planting Fields Arboretum, originally a private estate, is known to have

been landscaped partly with plants that originated in Europe (G. Clarke, personal communication).

The following adult description of *P. variabilis* is taken from Aukema (1981), who discussed color variation found among populations in the Netherlands and Great Britain. Similar color variation is found among Long Island populations we examined. Females tend to be reddish brown, males dark brown or fuscous and more slender.

Adult.—Small (3.3–4.4 mm), oval, dorsal habitus as in Fig. 1, yellow brown, red brown, bright orange red, sometimes dark brown. Pubescence consisting of both shiny golden scales and semi-erect black setae.

Head dirty yellow brown to dark brown, sometimes with a reddish tinge. Antenna yellow brown, with extreme base of segment I more or less dark or black.

Pronotum light yellow brown to dark brown, tinged with black and sometimes anteriorly and/or posteriorly with dark markings; sometimes (especially in female) tinged with red or orange red. Mesoscutum and scutellum colored as pronotum; lateral margins of mesoscutum and scutellum and apex of scutellum usually somewhat lighter.

Hemelytra light yellow brown to dark brown, especially near apex more or less tinged with red or orange red. Cuneus yellow brown, red brown to deep red, basally more or less white along fracture. Wing membrane dark gray to black, with a clear spot just behind the outer cell. Veins colorless to grayish, usually tinged with red.

Femora dark brown, broadly red to orange red apically, sometimes with a few indistinct dark spots beneath. Tibiae light yellow with black spines arising from distinct dark spots, especially on hindtibia. Tarsi yellow, segment 3 dark apically.

Ventral surface light red brown to dark brown.

Structural differences of the aedeagus and parameres offer the most dependable characters for separating species of *Psallus*. The male genitalia of *P. variabilis* are briefly described here to facilitate recognition. The right paramere is large and oblong (Fig. 3a), while the left paramere is also large with the sensorial process broadly rounded apically (Fig. 3b, c). The aedeagus is oblong and robust, with two lateral processes (Fig. 3d); the basal process is short and hooked at apex.

Kelton (1980) listed approximately 40 species of *Psallus* occurring in North America; Knight (1941) treated 13 of these species in a key to the mirid fauna of Illinois and eastern North America. *Psallus variabilis* will key near *P. amorphae* Knight in Knight's key, but differs from *amorphae* mainly by its lighter dorsal coloration, by its pubescence consisting of shiny golden scales and semi-erect black setae, and by its distinctive male genitalia (Fig. 3a–d).





Figs. 1, 2. Dorsal habitus of adults. 1, *Psallus variabilis*. 2, *P. albipennis*.

Fifth-instar nymph.—(In alcohol), Fig. 4. Length 3.0–3.1 mm; background color pale brown to reddish brown; head, pro-, meso- and metanotum and wing pads moderately, densely clothed with erect silvery setae; abdomen moderately clothed with erect pale to dark setae. Head: Length 0.40 mm, width across eyes 0.67 mm. Rostrum: Length 1.30–1.34 mm, reaching metacoxae. Antenna: Pale yellowish, extreme base of segment I dark or black, clothed with fine recumbent setae; segment I, length 0.25–0.26 mm; II, 0.67–0.70 mm; III, 0.50 mm; IV, 0.30 mm. Pronotum: Length 0.40–0.50 mm, median width 0.80 mm, anterior and posterior angles broadly rounded, somewhat uniformly dark brown to fuscous, especially borders; median line and other adjacent median areas pale, rather moderately and uniformly punctured. Meso- and metanotum: Length 0.60–0.67 mm, median width across wing pads 1.40–1.47 mm, moderately and uniformly punctured; wing pads relatively long, reaching slightly beyond apex of abdominal segment III, moderately coarsely punctured. Abdomen tapered to apex, mostly reddish; basal segments on mid-dorsal line marked with dark brown; small, irregular brownish spot on each side of midline on segments V–VIII. Apical 2 abdominal segments brownish dorsally. Dorsal abdominal gland opening conspicuous along suture between terga 3 and 4; opening (=Type 3 of Ak- ingbohungbe, 1974) with a sinuate sclerotized bar.

Forefemur dark reddish brown, apex pale; foretibia pale yellow, slightly darkened apically, clothed with fine, recumbent setae; foretarsus pale brownish. Mid- and hindfemora reddish brown; mid- and hindtibiae pale

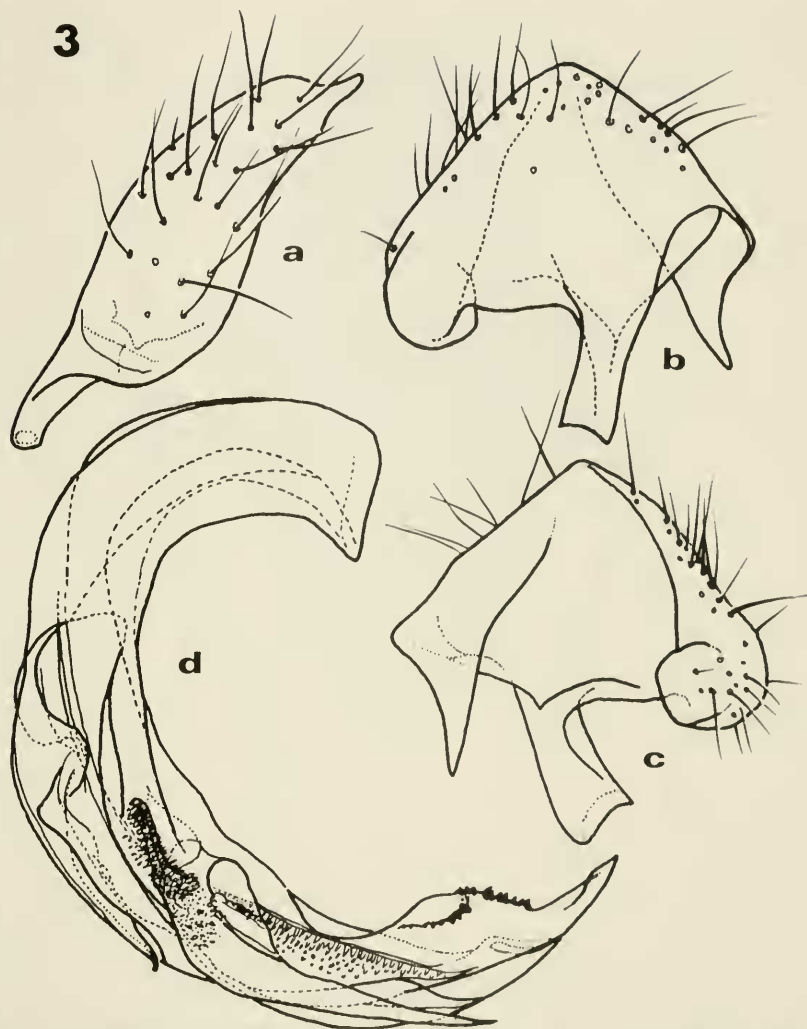
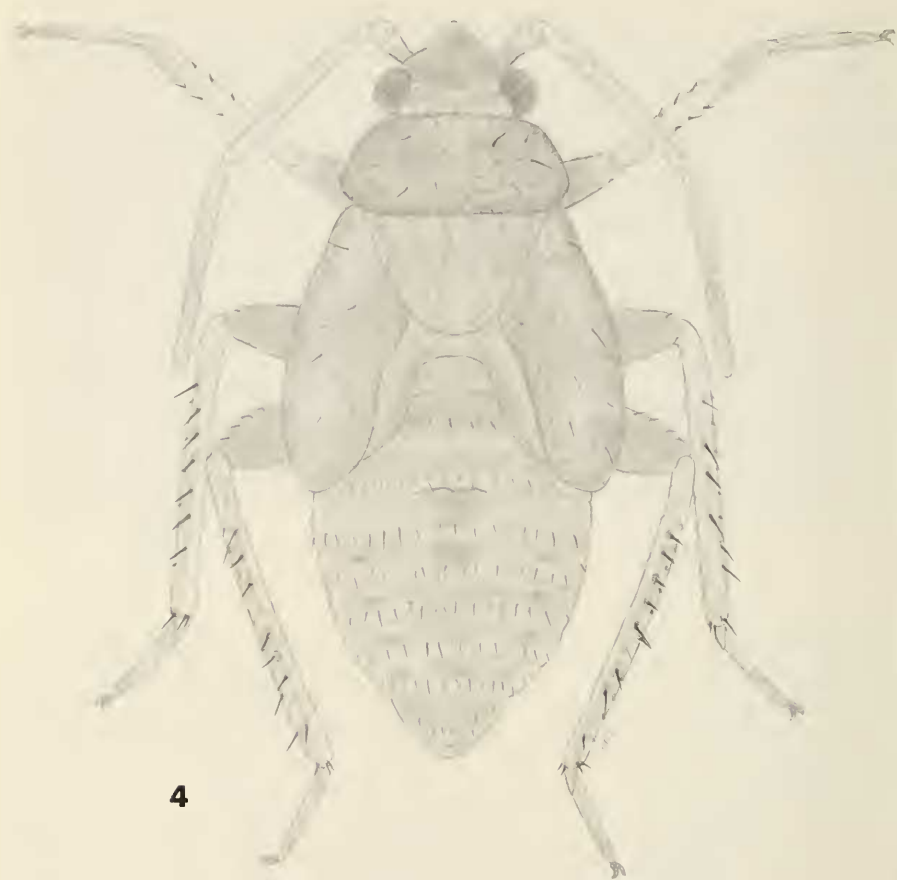


Fig. 3. Male genitalia of *Psallus variabilis*. a, Right paramere. b, c, Opposing views of left paramere. d, Aedeagus. (All structures reproduced from Aukema, 1981.)

yellow, with black, erect setae arising from black spots. Mid- and hindtarsi pale brownish. Venter pale reddish to fuscous, extreme lateral areas of abdominal segments brownish.

Material examined.—2 fifth-instar nymphs, collected from male catkins of *Quercus ilicifolia*, near Center Moriches (Suffolk Co.), Long Island, on May 30, 1981. Determined by association with adults.



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Fig. 4. Dorsal habitus of *Psallus variabilis* nymph, fifth instar.

***Psallus albipennis* (Fallén), NEW COMBINATION**

This common and widely distributed European species has been termed a "Holopalaearctic" mirid (Wagner, 1952). Kullenberg (1944) noted that *P. albipennis* is restricted to feeding on plants of the genus *Artemisia*, with *A. absinthium* L. as the principal host, although Kullenberg also observed feeding on *A. vulgaris* L. and on an ornamental species. He found that the bugs prefer unopened flower buds but also will feed on leaves and stems. Adults of this bivoltine mirid are present from mid-July to early September (Kullenberg, 1944), or late June to October (Southwood and Leston, 1959). Kullenberg determined that the egg represents the overwintering stage of this species.

*Psallus albipennis* so varies in coloration that at least seven varieties have

been described (Reuter, 1878). Wagner (1941) described two new *Artemisia*-feeding species of *Plagiognathus* that had been confused with *albipennis*; since then, several other species, all restricted to *Artemisia*, have been described in the subgenus *Poliopterus* Wagner of *Plagiognathus* (see Wagner, 1975). In disagreeing with Wagner's (1941) interpretation, Southwood and Leston (1959) regarded the extreme morphological forms occurring on different species of *Artemisia* as a single, quite variable species. The different forms show "no constant differences between them," and second generation adults of *albipennis* are somewhat larger than those of the first generation.

The only published North American record of *P. albipennis* is from Bradore Bay, Quebec, on the easternmost point adjoining Labrador; no dates or number of specimens were given (Moore, 1950). Carvalho (1958) did not list a New World record for *albipennis* in his catalogue of world Miridae. We found that Moore's record was based on specimens taken during August 2-8, 1930, by the coleopterist W. J. Brown, who spent the summer of that year collecting at Thunder Bay and at Bradore Bay "on the western extremity of the Straits of Belle Isle" (Brown, 1932). Most of his material is housed in the Canadian National Collection in Ottawa, with the remainder of the series in the H. H. Knight collection at the National Museum of Natural History, Washington, D.C. Knight's collection also contains 32 specimens of *P. albipennis* from Cook Co. in northeastern Minnesota; this record, actually predating that from Bradore Bay, was never published. The data for this early collection of *P. albipennis* are: Grand Marais, Minnesota, Aug. 13, 1922, H. H. Knight.

On May 30, 1981, we found a large population of *P. albipennis*; adults and a few fourth- and fifth-instar nymphs were feeding on *Artemisia campestris* L. growing in dry, sandy soil along a railroad south of Yaphank. One of us (AGW) and T. J. Henry returned to the same site on August 29 and found adults and instars II-V. In 1982 we found two adults on *A. campestris* in Suffolk Co., near the Suffolk County Air Force Base, NW of Quogue.

It appears that this species breeds throughout the summer and that instead of the two annual generations reported for Europe there are at least three on Long Island. We consider *P. albipennis* to have been introduced from Europe with man's commerce. This species can easily be overlooked and may be more widespread in eastern North America. Crossley (1980), in explaining the lack of records for Yorkshire, England, pointed out that because these bugs develop on "plants of waste places they often escape the attention of entomologists!"

As we were collecting mirids from *Artemisia campestris*, we suspected we might be dealing with a European species. We were not aware of any phylines associated with *Artemisia* spp. in the eastern U.S. (they are common on these plants in the western states), and Long Island is especially



liable to accidental introductions with commerce. We described the Long Island mirid to T. J. Henry, who suggested that it might represent *Psallus waldeni* Knight, a species whose identity has long remained in doubt. Knight (1923) described *waldeni* from two females taken at New Haven, Connecticut, on May 30, 1911. The Connecticut record is cited by Blatchley (1926) and listed by Carvalho (1958), but no further records are available. If this species has been collected since 1911, it apparently has not been correctly identified. After comparing our specimens with Knight's holotype, Henry concluded that even though only females of *waldeni* were available, the Long Island material was conspecific. We then borrowed European specimens of *P. albipennis*. After examining and comparing the male genitalia of the Yaphank specimens with those of the borrowed European specimens, we concluded that our material was conspecific with the Old World species. Therefore, we propose a NEW SYNONYMY; *Psallus waldeni* Knight (1923) is a junior synonym of *P. albipennis* (Fallén).

As Henry (1981) pointed out, the generic limits of *Plagiognathus* and *Psallus* are poorly defined; the North American species of both genera are badly in need of revision. At the time Knight (1923) described *waldeni*, he separated the two genera on the basis of simple setae (*Plagiognathus*) vs. tomentose or scalelike setae, plus simple setae (*Psallus*). Because *waldeni* has sericeous setae, especially on the head and pronotum, he placed the new species in *Psallus*. Because of this setal type, *albipennis* will key to *Psallus* in Knight (1923, 1941) and in some of the European literature. Wagner (1975) uses scalelike setae to separate *Plagiognathus* from *Psallus* but places *albipennis* in the former genus. The mirid specialists L. A. Kelton and T. J. Henry feel that *albipennis* properly belongs in *Psallus*, and they have allowed us to formalize this generic transfer. We therefore recognize the new combination, *Psallus albipennis* (Fallén).

Adults of *P. albipennis* are characterized by the following brief description, drawn from the European literature and from specimens at hand.

Adult.—Small (2.8–3.3 mm), elongate-oval, dorsal habitus as in Fig. 2, color highly variable, usually grayish white but varying from pale to brownish black. Pubescence consisting of dense, long, silvery white setae.

Head dark in front. Antenna with segment I dark or black; segment II dark or black at base, paler at apex; segments III and IV pale.

Pronotum transverse, blackish; lateral margins slightly rounded, brown or grayish white. Scutellum blackish.

Hemelytra usually dark. Cuneus pale at base. Wing membrane dusky, veins and spot below cuneus white or pale.

Hindfemur, and usually also fore- and midfemora, black or blackish brown, yellow brown at apex. Fore-, mid-, and hindtibiae yellowish, with row of black spots, each bearing a black seta. All tarsi brownish.

The male genitalia of *P. albipennis* are characterized as follows: The right

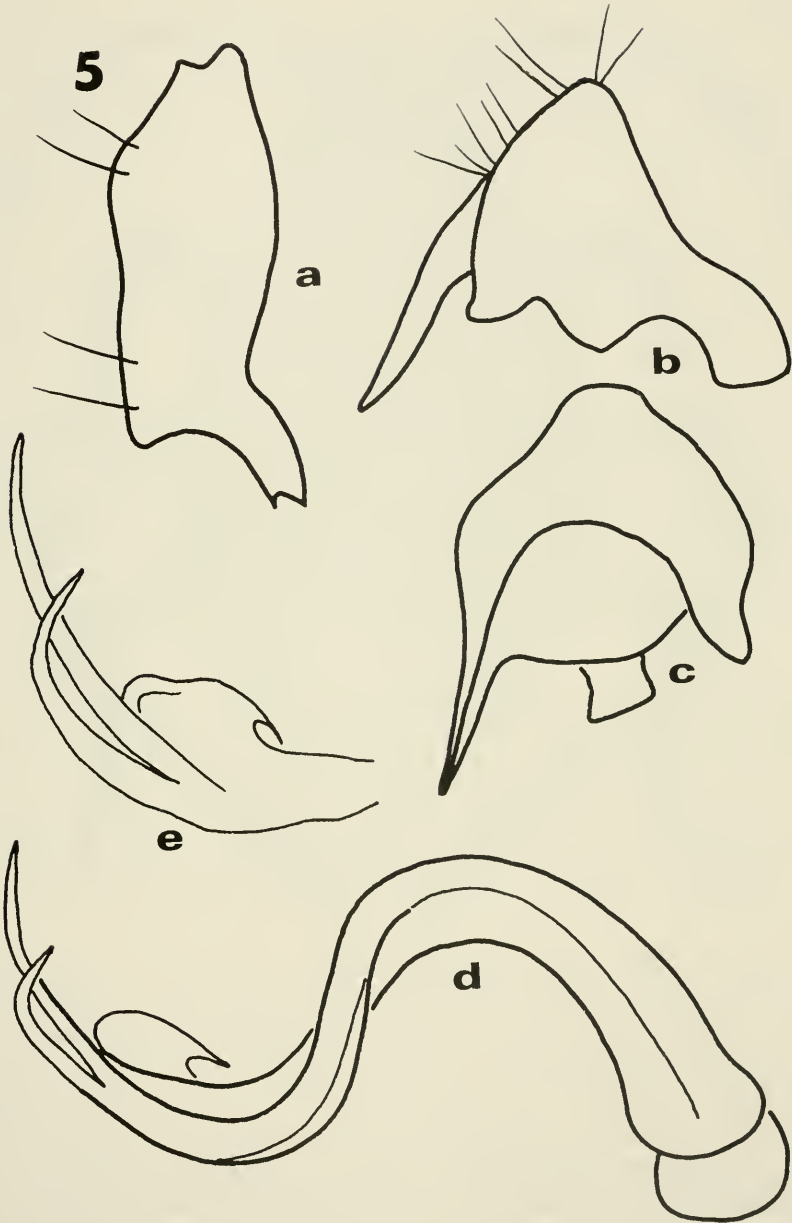


Fig. 5. Male genitalia of *Psallus albipennis*. a, Right paramere. b, c, Opposing views of left paramere. d, Aedeagus. e, Close-up of apex of aedeagus. (All structures redrawn from Wagner, 1941.)

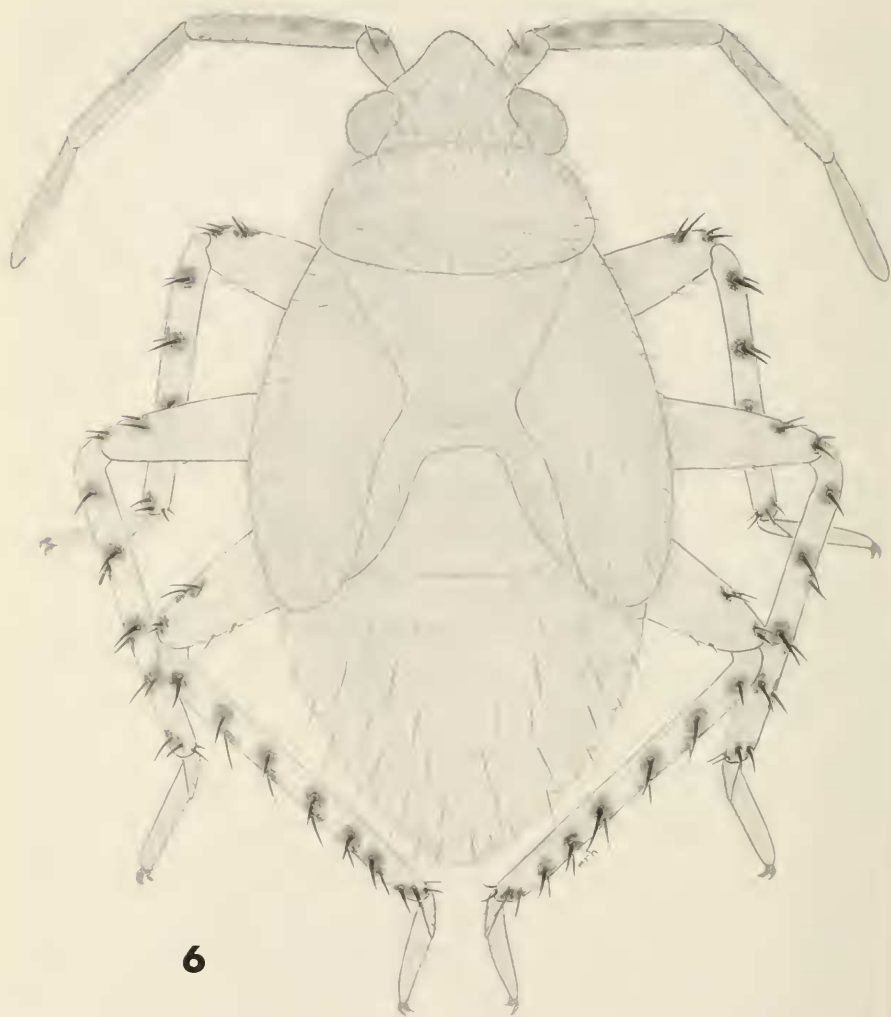


Fig. 6. Dorsal habitus of *Psallus albipennis* nymph, fifth instar.

paramere is moderately large with a small, but prominent subapical protuberance (Fig. 5a), while the left paramere is shaped as in Fig. 5b,c. The aedeagus is quite long and broadly curved (Fig. 5d); the apical appendage is short, evenly curved and directed laterally, and the apex of the membranous appendage is pointed and caudally directed (Fig. 5e). *Psallus albipennis* does not key readily to any species in Knight (1941), but will key to

*waldeni* n. sp. in Knight (1923); *waldeni* Knight is a junior synonym of *P. albipennis*.

Fifth-instar nymph.—(In alcohol), Fig. 6. Length 2.1 mm; background color pale cream white; head, pro-, meso-, and metanotum, wing pads, and basal abdominal segments moderately, densely clothed with long, semi-erect pale setae; apical abdominal segments clothed dorsally with long, semi-erect, pale, brownish setae. Head: Length 0.30 mm, width across eyes 0.60 mm. Rostrum: Length 1.0 mm, extending to metacoxae; pale white, apex infuscated. Antenna: slightly brownish, inner margin of segment I at apex with large dark spot bearing 2 erect dark setae; basal  $\frac{1}{3}$  of segment II mottled with small brownish spots; all segments clothed with fine recumbent setae; segment I, length 0.20 mm; II, 0.48 mm; III, 0.40–0.45 mm; IV, 0.30 mm. Pronotum: Length 0.27–0.30 mm, median width 0.60–0.70 mm, anterior and posterior margins broadly rounded, each with a very small dark spot bearing a single seta; surface uniformly cream white. Meso- and metanotum: Length along median line 0.40–0.60 mm, median width across wing pads 1.0 mm, uniformly pale cream white, apices slightly infuscated, extending nearly to apex of abdominal segment IV. Abdomen broadly tapered to rounded apex, uniformly pale cream white. Dorsal abdominal gland opening small and inconspicuous along suture between terga 3 and 4; opening (Type 3) with sinuate sclerotized bar.

Fore-, mid-, and hindfemora pale, each with a large, dorsal, subapical dark spot bearing a single dark seta, and a smaller, apical, dark spot bearing 2 setae. Fore-, mid-, and hindtibiae pale white, slightly infuscated apically, with 2 rows of large dark spots along dorsal face bearing dark setae. Fore-, mid-, and hindtarsi brownish. Venter pale cream white throughout.

Material examined.—8 fifth-instar nymphs, collected from foliage of *Artemisia campestris*, growing along Rt. 21 south of Yaphank (Suffolk Co.), Long Island, on May 30, 1981. Determined by association with adults.

#### ACKNOWLEDGMENTS

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(University of Connecticut, Storrs) for the loan of European specimens of *P. albipennis*. Robert J. Hill (York College of Pennsylvania, York) provided the identification of *Artemisia campestris*. Finally, we are grateful to the Planting Fields Arboretum, Oyster Bay, Long Island, for permission to collect on the arboretum grounds, to Gene Clarke, arboretum archivist, for information on the history of the arboretum, and to J. F. Stimmel (Pennsylvania Department of Agriculture, Harrisburg) for photographing adults of both phyline species.

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